Sonic Surface Area Modification of Bullets in Support of Steering Rounds to LASER-designated Targets, Extending Effective Range of Barrett M-82 to Up to Five Miles

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Introduction

A number of "smart bullet" research programs have been initiated over the years and promptly canceled, citing the ineffectiveness, high cost, and limited usefulness of such hypothetical munitions.

Abstract

In the twenty years since the last major research initiative in this area, new technologies have been developed which, if leveraged correctly, could be used to make effective and affordable kills with "smart bullets" possible.

Guided projectile munitions, if made available, would afford obvious advantages to our own operators in situations where snipers wish to reach targets outside of the traditionally accepted effective range of their rifles.

Two primary technologies are needed to make such a munition effective. The first is a membrane-style sonic resonator also known as a "sticker speaker," a prototype of which was demonstrated earlier this year at MIT. These thin, transparent stickers can be adhered to any surface and can produce enough sound to enable a user to enjoy a piece of music or a television program.

The second needed technology is a high-resolution, high-refresh rate LiDAR system for projecting the likely point of impact of a bullet after it is fired so as to enable instructions to be sent to the round concerning in which direction it should steer itself.

Beneath the surface of the front-facing part of the bullet, four individual membrane-style sonic generators would be embedded. As the bullet rotates, the area of the bullet needing to be resonated would change thousands of times per second. Modern switching capabilities make this frequency of switching possible, enabling the system to resonate the appropriate portion of the frontus of the bullet consistently, affecting the successful steering of the bullet to the target.

By resonating the smooth skin of the bullet in select areas, the surface area of that part of the frontus is increased, causing an asymmetry of drag on one side of the round. This constitutes the steering mechanism of the guided projectile munition.

For that steering mechanism to be effective, both the projected arrival point of the munition (absent any artificial change to trajectory) and the intended target point, as designated by LASER need to be ascertained. The system needs to rapidly communicate guidance information to the munition. The

munition must, furthermore, be able to receive radio signals as well as know which direction is "up."

The greatest challenge is in estimating the position and trajectory of a small munition moving at high velocity. This has now crossed into the realm of possibility as man-portable drones, each of which can be equipped with its own LiDAR units supporting trajectory calculation, can be used to inform real-time corrections of bullet trajectories in mid-flight.

Of equal challenge is enabling the bullet to know which way is up. At such high rotational rates and G-forces, traditional means of assessing this are essentially useless. This is another area in which drone swarms can prove useful. The addition of an IR receiver on a single side of the bullet can enable the munition to glimpse a bright IR light source directly overhead emitted deliberately by one of the drones in the swarm. This would act essentially as a "north star" or fixed reference point that calibrates the resonator system. Once the munition knows which way is "up," the munition can get its bearings. This guide would need to be present for the duration of the flight of the round as rotational speeds decrease over time and cannot be predicted in advance. If, for instance, the bullet needs to pitch left to arrive at the target, such a bullet would, after being sent the signal to do so, would wait for the beacon light source to be at a 0-degree bearing (straight overhead) before sending a signal to resonate to the left-hand side of the round relative to the side featuring the sensor.

Conclusion

In summary, an IR receiver, four membrane resonators and a radio built into an M33 round combined with a drone swarm with LiDAR capability, and an M-82 rifle are all that are needed to help steer a round to a target with unprecedented accuracy.

By LASER-designating targets and gathering trajectory data from a number of drones with different vantage points, accurate instructions can indeed be relayed to such a munition to enable kills from ranges of up to five miles.